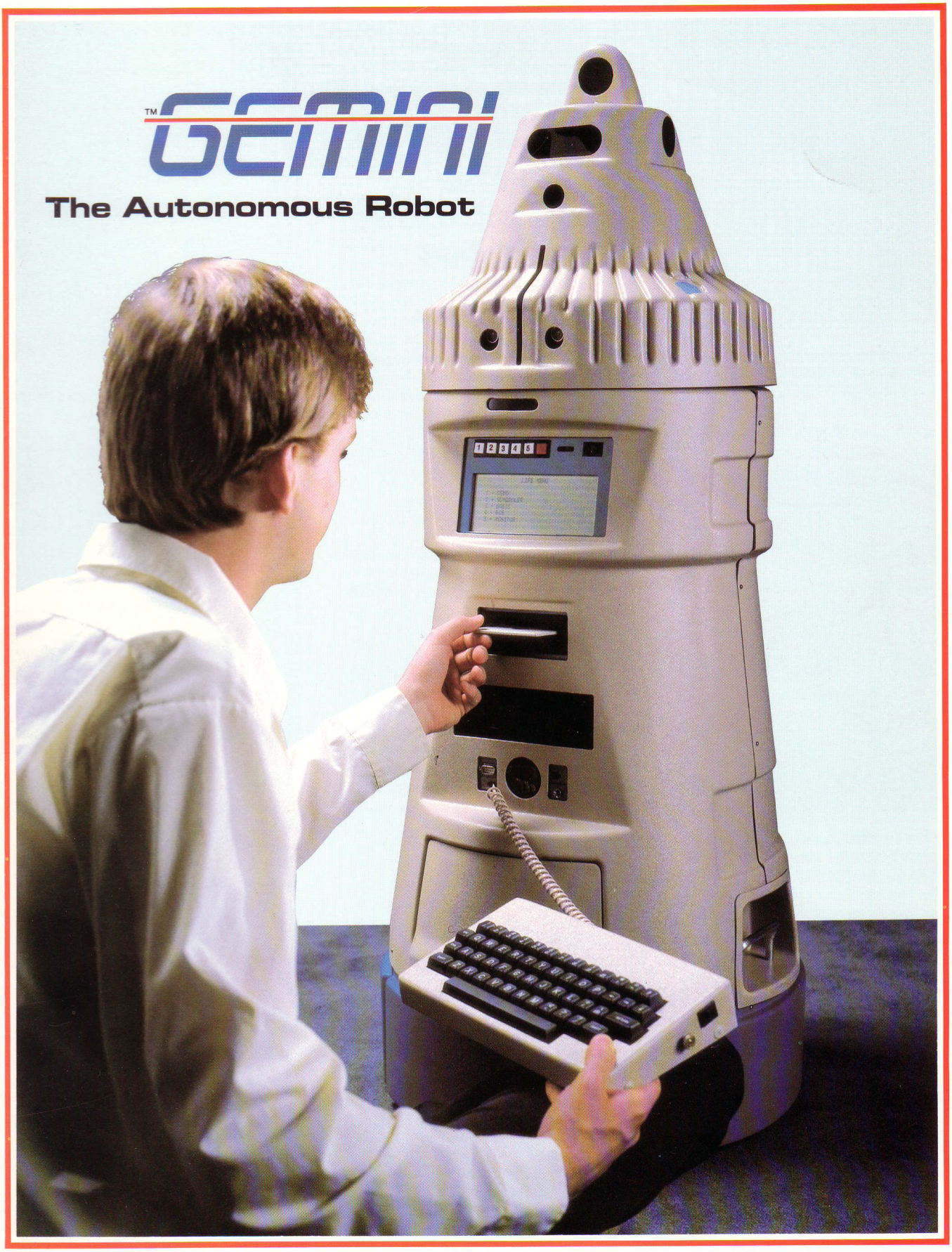
GEMINI™

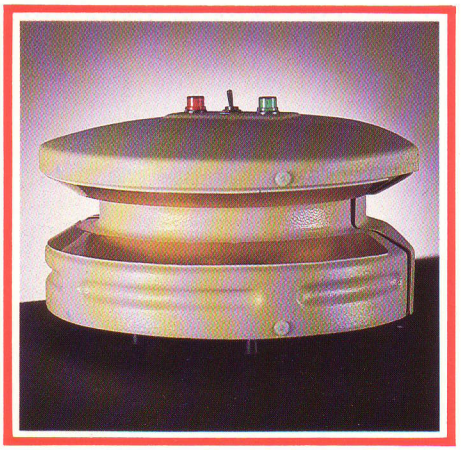
The Autonomous Robot



arctec systems™

GEMINI's liquid crystal display with Life Menu. Above display is keyboard infrared receiver, below is optional disk drive.

Schedule GEMINI to wake you up in the morning, remind you of your schedule for the day, and recite you a poem!



GEMINI automatically keeps its batteries charged by returning to the charger whenever necessary.

Meet GEMINI™ The Autonomous Robot

GEMINI is a self-navigating, self-charging, multiple microprocessor-based, life size robot with an unprecedented 100K built-in artificial intelligence operating system, speech recognition, speech synthesis, multiple environmental sensors and a rugged computer controlled propulsion system.

Prepare Your Family For The Future . . . Now

Bring GEMINI home and turn it on. Watch in wonder as GEMINI undergoes a complete checkout of all its systems. GEMINI tells you everything it's doing, while displaying data on the 40-character by 8-line, low-power liquid crystal display at the same time. Now you are ready for a lifetime of discovery in the new world of personal robotics!

Press the DEMO function key and let GEMINI teach you something about artificially intelligent machines. Let it sing you a song while it also plays accompanying background music. Try a few laser blast sound effects for your children. Let GEMINI use its artificial intelligence to make up space travel stories and poetry. Push another button and let it take you into the world of machine voice recognition. Give GEMINI commands by voice. Let it tell you the time, temperature, barometric pressure, sound level, light level and the voltages of its three batteries. Watch the look of amazement in your children's eyes as GEMINI moves off the charger, performs a dance to its own music and then returns, all by itself, to the battery charger.

Now exit the DEMO mode (you can show it to your friends later) and prepare everyone for the new family addition . . . the robot valet. Pull out GEMINI's full function, computer-controlled keyboard tucked away in its pouch and enter the SCHEDULE mode. You won't have to know anything about programming to turn GEMINI into your personal valet. Enter a wake up call and a reminder message if you wish. Tell GEMINI what room you will be in and it will find you . . . all on its own. Set up a household security routine for the robot if you wish.

Before you get carried away completely, exit the SCHEDULE mode and enter GEMINI's fabulous floating point, scientific, BASIC operating system. Pick up the easy to understand manuals and look at all the new BASIC commands which give you complete control over the sensors and auxiliary computers. Try a few new commands such as RANGE(HEAD), to get distances in feet from its head ultrasonic sonar; or BODY FORWARD, SPEED, DISTANCE, to watch GEMINI move forward at the designated speed for the designated distance. Let your mind wander to all the things you can make GEMINI do with this easy to use, English-like, language. Save a program or two on the optional low power WAFER drive or 3½-inch floppy DISK drive.

Gather your family around you and say "GEMINI!", loudly. The robot will respond with "GEMINI LISTENING!" and automatically enter the voice command mode. In this mode, the robot can recognize speech and respond to spoken commands. First, the robot must be trained to your voice . . . no problem for GEMINI. It will take charge and verbally direct the vocabulary training sessions as needed, for you and up to two other members of the family.

When the voice training is done, take turns commanding GEMINI to move about and perform various tasks. The robot will converse with you at the same time. You don't have to worry that GEMINI might lose the training or forget your voice. The robot will keep its memory alive and adapt to your voice, even if it changes. GEMINI doesn't even care if you speak in a foreign language.

If you have the optional REMOTE COMMUNICATION COMPUTER, enter GEMINI's REMOTE COMPUTER control mode and dim a few lights in the house or turn off (permanently?) the TV. Then dial up the "SOURCE"SM or "COMPUSERVE"™ and have a short session. Dump a program or two to your printer. If you have a personal computer with an RS232C serial port, hook it up to the REMOTE COMMUNICATION COMPUTER and let GEMINI talk to it, or control GEMINI from your computer.

If you are really venturesome, too excited to sleep, or just plain curious, enter GEMINI's MONITOR mode. You will find yourself at the robot's very heart. Right where you can make GEMINI do anything your abilities will allow. Check out the systems manual; you will find all of the useful new CMOS 65C02 microprocessor source codes, with user entry points to a multitude of subroutines. You might even outdo the programming staff of the GEMINI design team at this level. Let your imagination run wild. It's your robot, built for you and your children's future.

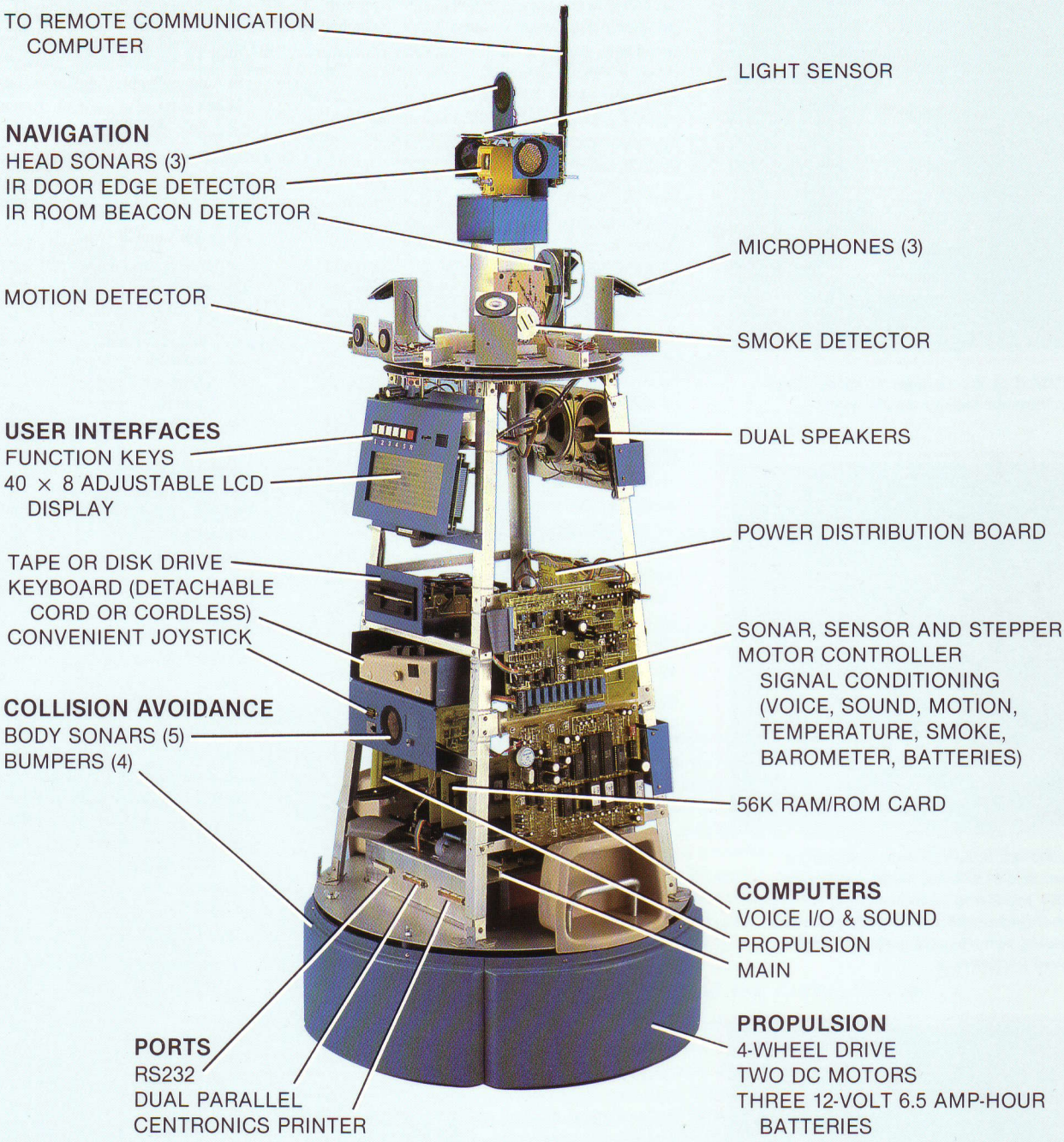
Front view of GEMINI showing sonars, lifelites, charging bumper, and three piece ABS plastic shell.

You Will Think GEMINI Is Really Alive

GEMINI is not an ordinary personal robot. GEMINI doesn't need a human to plug it into its charger (and unplug it) like other robots. GEMINI does that for itself.

GEMINI doesn't need a human to first lead it around its surroundings in order to navigate, either. GEMINI doesn't follow pre-taught paths, which take time to enter and which can't be repeated when the robot's wheels slip, or someone moves the furniture. GEMINI figures out shortest paths from room to room, and around obstacles, all alone.

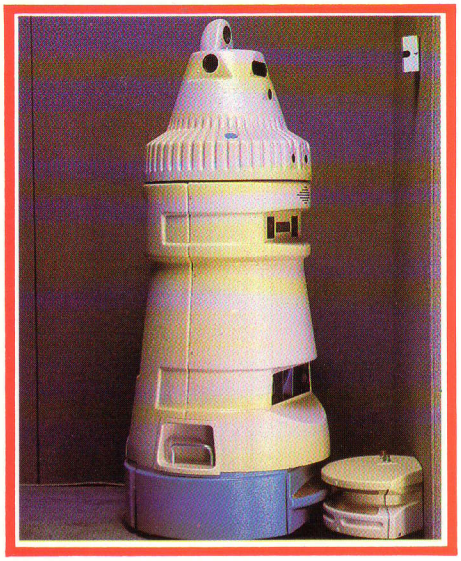
All you have to do is install a small, attractively packaged, infrared, coded room beacon in each room (up to 15 separate rooms) and a small door edge reflector on one side of every doorway. GEMINI will then ask you some questions about the locations of these room beacons and door edge reflectors. You type in the answers. That's all. Now you can command the robot by voice, from BASIC or from the SCHEDULER to move to any of these rooms. GEMINI will use its artificial intelligence to figure out how to get there.



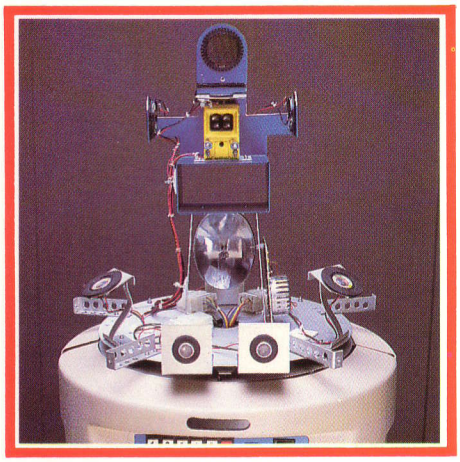
GEMINI has a *real* collision avoidance system on board. Nine Polaroid ultrasonic sonars are used for this purpose. The sonars are placed strategically on the 48-inch high frame. GEMINI sees an adult environment, as we do, not the environment of a toddler which is seen by other (smaller) robots.

In the event that the array of sonars misses an object in its path, GEMINI also has a 20-inch circular base with contact bumpers that are constantly monitored by the propulsion computer. These bumpers are on the robot's greatest outer extremity, so it is unlikely to bump into objects without knowing it. GEMINI constantly monitors its sonars while in motion just in case the bumpers miss a low obstacle. GEMINI's ability to turn 360 degrees within its 20-inch radius helps prevent the robot from getting trapped in tight spots.

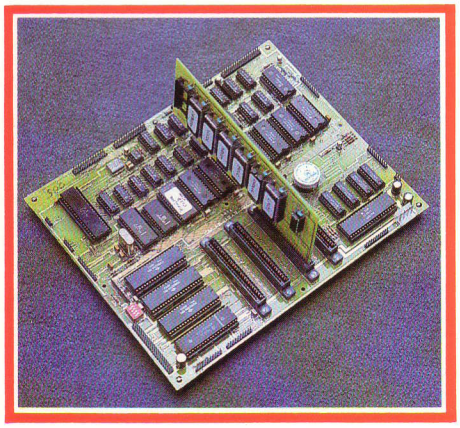
GEMINI's four wheel drive propulsion system allows it to move about on any surface and over normal obstacles found in a typical household. This robot won't be stopped by door sills or shag rugs. And the three 6.5-amp-hour sealed batteries are mounted right in the middle of the drive system, so the center of gravity is kept very low and the principal weight is equally distributed over the driver wheels. A truly sound foundation for a robot.



GEMINI at the charger location. Note the infrared beacon on the wall.



GEMINI's head contains sensors for motion and smoke, microphones for voice input and sound sensing, infrared room beacon and door edge detectors, ranging sonars, and room for additional peripherals.



GEMINI's main computer has all functions most users need, including serial and parallel ports. Four expansion slots on the bus (similar to Apple's) allow addition of many Apple-type peripheral cards.

But What Can GEMINI Do. . .

GEMINI can help you and your children prepare for the burgeoning field of robotics. As an educational tool alone, GEMINI is a sound investment. You can program the robot to tutor your children in most any subject, such as spelling, reading, history, music or math. Such educational tasks are made enjoyable with a robot that not only displays information on its screen, but also speaks to the children and accepts their voice commands.

But this robot is not a toy. GEMINI can introduce *you* to the field of artificial intelligence as well as teach you about microprocessors in a multitasking environment. The robot can also teach you the principles of automatic control of electromechanical devices. You can even learn about advanced topics such as machine speech recognition and computerized speech. All of GEMINI's devices employ the latest equipment in these high technology fields.

GEMINI is also just plain entertaining. You and your family will enjoy many hours just watching the robot figure out how to get around obstacles in its path and how to move through open doorways. You will gain a new perspective on artificial and human intelligence. You will also enjoy listening to the robot create a nearly endless variety of poetry and stories.

The music lovers in the family will particularly enjoy GEMINI. There are numerous canned songs built in, such as Scott Joplin's "The Entertainer" and "Music Box Dancer", and songs with vocals like "The Star Spangled Banner", "Rain Drops Keep Falling on My Head" and many more. You can even write your own music with accompanying vocals and save these on wafers or disks for later replay.

GEMINI can also be your personal valet. You can enter numerous tasks for the robot to handle throughout the day, and all you need to know is how to push keys on a keyboard. These tasks include reminders such as birthdays, anniversaries, and your schedule of activities; morning wake-up calls; playing games with the children; and tutoring. And with the optional REMOTE COMMUNICATION COMPUTER, GEMINI can even control your home environment by regulating your thermostat for minimum energy consumption, sprinkling the lawn, turning off the lights and even turning on your coffee maker in the morning.

GEMINI can also be your personal security guard. You can easily enter your own unique security routines for any period of the day, for any area of your home, from the SCHEDULE mode. You might even program the robot to use its artificial intelligence to generate its own security patrol. When the robot can call upon the optional remote computer, GEMINI becomes a particularly effective security guard. It is well known that only the most hardened criminals will enter a house that is occupied. Just schedule GEMINI to make the house look occupied. Let the robot move around turning on/off the TV, radio and lights. Let it talk in several different voices to make it appear that *several* people are in the house. Let the robot use its sophisticated array of motion and infrared sensors to spot an intruder, and then schedule GEMINI to phone you if something is detected. If you are worried while you are away, you can even phone the robot for a status report. And GEMINI can use its onboard smoke detector to watch out for fires.

GEMINI can be a tireless companion for the young, the very old and the disabled. The robot can do many everyday tasks for people who find it difficult or impossible to do them manually. GEMINI can be programmed to understand people with difficult-to-understand speech which it can then translate into understandable speech. The robot can turn electrical lights and appliances on and off by voice command. GEMINI can even dial telephone numbers.

But the biggest benefit—no matter *how* you use GEMINI—is that you and your family increase your familiarity with the robot itself. The more you experiment with it, the more you discover about its potential.

Start by using the built-in voice command system. Then invent your own routines and link them into the built-in voice command software. Then write some BASIC programs using the robot commands. As you master GEMINI's advanced BASIC control language, you will be able to make the robot perform very complex tasks. Save these programs on the WAFER tapes or 3½-inch floppy DISK and trade them with your friends. Try your hand at writing an EXPERT system to predict the weather using GEMINI's built-in barometer.

GEMINI will go as far as your imagination can take it. Best of all, GEMINI is designed to grow with you. As your skill and experience with robotics increase, you may want to add new peripherals or design your own. In addition to the built-in 16-channel A/D converter, real-time clock, Centronics printer port, RS232 serial port and 48 input/output bits, there is room for four plug-in options (bus similar to Apple), such as a prototyping board for experimenting with interfaces to other equipment. There are two uncommitted serial ports with built-in software drivers to add additional computers on board. Plenty of room is available in the body and on the rotatable head platform to attach experimental devices. And to power all of your experiments and peripherals there is a super efficient onboard switching power supply. There are many more options to come, because GEMINI was designed from the beginning to accommodate increased power and capability as your requirements change.

Specifications
Hardware

- Autonomous operation, self navigating, self charging
- 48 inches high, 20 inches in diameter, 70 pounds
- 9 ultrasonic collision avoidance and navigation sensors
- Three on-board computers (all high-speed CMOS Rockwell 65C02's)
  - Main computer—64K ROM, 56K RAM
  - Voice Input/Output and Sound computer—24K ROM, 16K RAM
  - Propulsion Control computer—2K ROM, 2K RAM
- Full size, cordless, detachable keyboard with 6303 CMOS microcomputer (2K ROM) carried by robot
- Remote Communication computer—8K ROM, 32K RAM (optional)
- 40-character by 8-line low-power alphanumeric liquid crystal display
- Light, sound, temperature and battery voltage sensors; barometric pressure and smoke sensors optional
- 16-channel, 8-bit CMOS analog to digital converter
- Real time clock, RS232 port, Centronics printer port, hardware random number generator
- Four peripheral expansion ports using bus structure similar to Apple
- Convenient joystick controller
- Low power WAFER (endless tape) or 3½-inch floppy DISK drive (both optional)
- Charger— self charging type, anti-static mat

Software

- 100K integrated artificial intelligence operating system
- Automatic self-checking and diagnostics on powerup
- Extensive built-in DEMO program—pushbutton operation
- Multiple user, 256-word voice recognition system with adaptive learning ability
- Integrated VOICE COMMAND LANGUAGE (VOCOL)—optional
- Advanced, easy to use task SCHEDULER program
- User-configurable security guard program (optional)
- Third generation unlimited vocabulary speech synthesizer with text-to-speech software
- Full floating point BASIC with robot control commands (optional)

Documentation

A complete, easy-to-follow Users' Manual provides clear instructions on initial set-up and day-to-day use, including a large section on the extended BASIC language. The Technical Reference Manual contains valuable information on the robot's "insides" (including schematics and listings) which hobbyists, educators and experimenters will find useful. An optional "Young User's Manual", written for the youngster from age 8-12, introduces the younger members of the family to the exciting world of robotics, and includes many experiments and games that are lots of fun as well as educational!

Arctec Systems and the Arctec Group

Arctec Systems, Incorporated, is a member of the Arctec Group, an international group of companies with 14 years of engineering experience. Arctec's remote data acquisition systems that function at 40 degrees below zero in the Arctic use microcomputers and battery power systems similar to those designed for GEMINI. And Arctec's experience designing radio telemetry links that transmit data back from the Arctic helped in designing GEMINI's optional radio system. Arctec Systems' GEMINI Team includes engineers and technicians in the fields of electronics, mechanical and structural engineering, control systems engineering, computer science, and artificial intelligence. In short, a complete robotics engineering team.

Apple™ is a trademark of Apple Computer, Inc.
CompuServe™ is a trademark of CompuServe, Inc.
The Source℠ is a service mark of Source Telecomputing Corporation, a subsidiary of The Reader's Digest Association Inc.

arctec systems™

9104 Red Branch Road
Columbia, Maryland 21045
(301) 730-1237 • Telex 87-781